

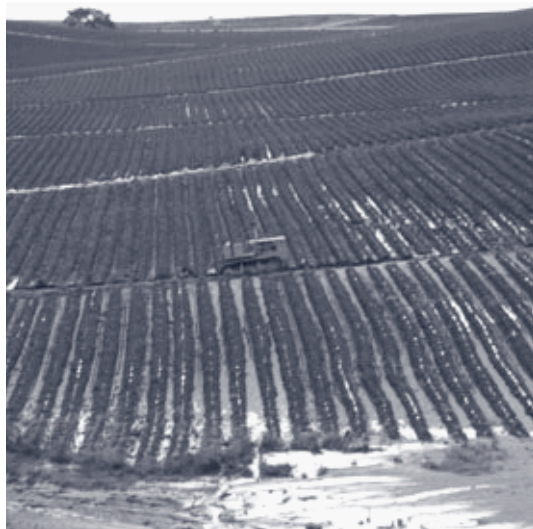
Sediment Contaminants

The sediment contaminant indicator in the nation's estuaries is rated fair. National and regional monitoring programs conducted by EPA and NOAA provide information on the concentrations of contaminants found in estuarine sediments throughout the United States. Measurements of nearly 100 contaminants, including 25 PAHs, 22 PCBs, 25 pesticides, and 15 metals, have been taken at each site. Long et al. (1995) developed ERM and ERL values that were used as guidelines to determine sediment condition. Poor condition was determined to be an exceedance of one or more ERMs, and fair condition was determined to be an exceedance of five or more ERLs. Poor sediment contaminant condition was observed in 7% of the estuarine sediments in the nation, and fair condition was observed in an additional 8% (Figure 2-13). The highest proportion of regional sediments exceeding these ERM guidelines occurred in Puerto Rico (23%), Gulf Coast (11%), and Northeast Coast (8%) estuaries.

Sediment Contaminant Criteria (Long et al., 1995)

ERM (Effects Range Median)—Determined for each chemical as the 50th percentile (median) in a database of ascending concentrations associated with adverse biological effects.

ERL (Effects Range Low)—Determined values for each chemical as the 10th percentile in a database of ascending concentrations associated with adverse biological effects.



Many of the activities that take place on land can also effect the marine life in the Monterey Bay National Marine Sanctuary. Agriculture, an important multi-billion dollar industry, can also deliver pesticides and sediment loads to the sanctuary during periods of heavy rainfall.



Figure 2-13. National sediment contaminants data (U.S. EPA/NCA).

Endocrine Disruption in Fish: An Assessment of Recent Research and Results

Concern has arisen that certain environmental contaminants, as well as some naturally occurring compounds, have the potential to affect the endocrine system in animals. The endocrine system regulates a number of vital life processes, including reproduction, growth, development, and metabolism, through the production and action of hormones. Compounds that can either mimic or antagonize the action of endogenous hormones are termed endocrine disrupting compounds (EDCs), or endocrine disrupters. Studies on the identification and effects of EDCs have become an important area of human and environmental health research.

NOAA's National Centers for Coastal Ocean Science completed an assessment of recent laboratory and field investigations into endocrine disruption in freshwater and saltwater species of fish. Most of the research to date in fish in the United States and elsewhere has concentrated on reproductive endocrine disruption, although other areas of the endocrine system, such as thyroid hormone balance and function, may also be targets for EDCs. Laboratory studies revealed that a number of chemicals—including certain industrial intermediates (e.g., alkyl phenols and bisphenol-A), PAHs, PCBs, pesticides, dioxins, trace elements, and plant sterols—can interfere with the endocrine system in fish. The potency of these EDCs, however, is typically hundreds to thousands of times lower than that of naturally occurring hormones. Environmental endocrine disruption in fish can result in the presence of female egg proteins in males and reduced levels of natural hormones in males and females, as well as in the presence of both male and female gonadal tissue (intersex fish) in normally separate-sex species. Overt endocrine disruption does not appear to be a widespread environmental phenomenon in fish, particularly in the United States, but rather it is more likely to occur in locations adjacent to sewage treatment plants (STPs), near pulp and paper mills, and in areas of high organic chemical contamination. Some of the most severe impacts, including the presence of intersex fish, have been seen adjacent to STPs, particularly near certain facilities in the United Kingdom. Effects near STPs are thought to be caused primarily by natural and synthetic estrogens and to a lesser extent by degradation products of alkyl phenolic surfactants. Effects in fish near pulp and paper mills include reduced hormone levels and masculinization of females, and they have been linked to the presence of β -osterol, a plant sterol released during the paper-pulping process. In areas of heavy industrial activity and contamination, reduced levels of estrogens and androgens, as well as reduced gonadal development, have been seen in fish and are thought to be linked to the presence of PAHs, PCBs, and possibly dioxin.

For more information visit
http://nsandt.noaa.gov/index_endocrine.htm.



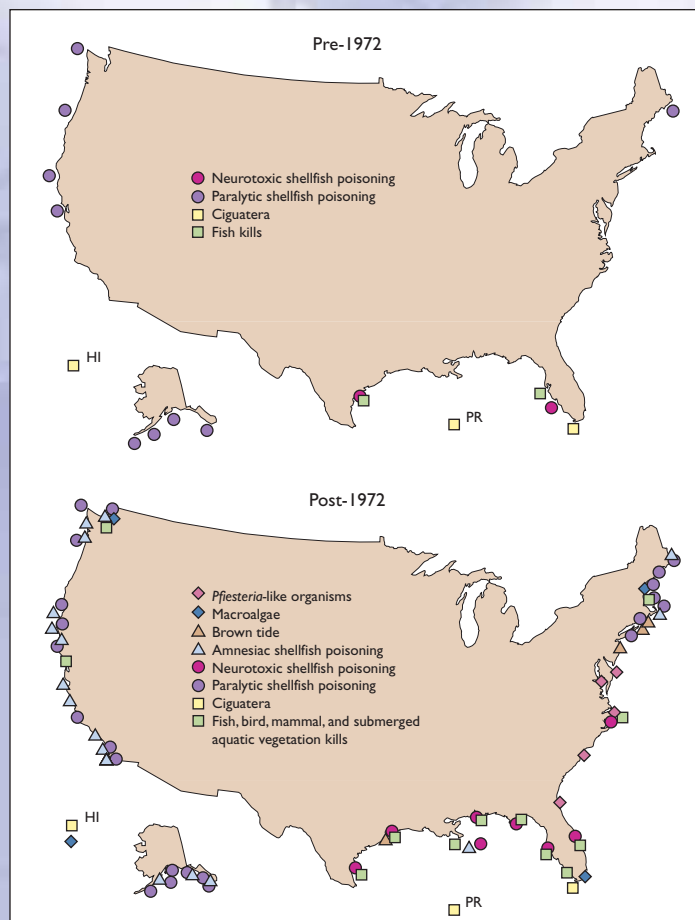
A mixed-species school of rockfish in the ocean above Cordell Bank, CA. (photo: Cordell Bank Expeditions)

Harmful Algal Blooms

The term “harmful algal blooms” (HABs) describes a diverse array of marine algae blooms that cause toxic effects in humans and other organisms; physical impairment of fish and shellfish; nuisance conditions from foul odors to discoloration of waters; overwhelming effects on ecosystems, such as severe oxygen depletion; and overgrowth of bottom populations. For some HAB species, concentrations of only a few algae cells per liter may produce toxic effects that cause illness or death to humans, marine mammals, and other marine life.

HABs have been responsible for an estimated \$1 billion in economic losses over the past few decades. These blooms have decimated the scallop fishery in Long Island’s estuaries; closed shellfisheries on Georges Bank, from North Carolina to Louisiana, and throughout the Pacific Northwest; killed hundreds of manatees in Florida, sea lions in California, and dolphins in the northern Gulf of Mexico; and caused significant respiratory illness in coastal residents and vacationers.

HABs are found in the waters of almost all coastal and Great Lake states, and they have been increasing in number and extent. Nationwide, there are more HAB species, more HAB events, more algal toxins, more areas affected, more fisheries affected, and higher economic losses today than there were 25 years ago. The reason for the apparent increase in HAB rates is uncertain. Some reports of new HAB events may simply reflect better detection methods and more monitoring rather than new species introductions or dispersal events. Today, more researchers and managers are surveying a greater number of waterways for the presence of HAB species, using more sensitive and more accurate tools than ever before.



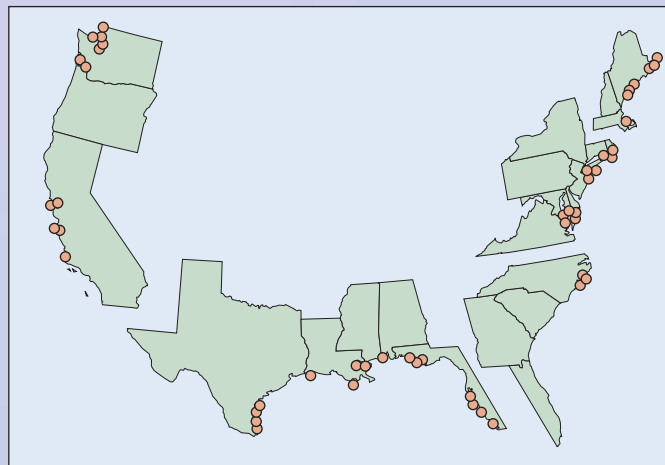
Since 1972, the number and distribution of HAB species and events in U.S. waters have increased (CENR, 2000).

Both natural events and human activities may also be responsible for the apparent increase in HAB rates. In addition, natural events, such as hurricanes, may play a role in the spread of HABs by dispersing the algae population and their nutrient sources via wind and water movement. Humans may also contribute to the expansion of species by transporting toxic species to new port areas in ships' ballast water.

Several causes of HABs have been identified—some natural, others man-made—and research continues to identify and distinguish these causes. Excess nutrients delivered to coastal waters may act as fertilizer and stimulate blooms in populations of naturally occurring algae.

Currently, management options are limited; they include developing methods to reduce the incidence and extent of HABs containing blooms and minimizing the impact of the blooms. Where possible, preventing the growth of HABs is preferable to treating the symptoms. It may be possible to prevent growth of some HABs (1) by controlling the nutrient inputs to HAB species that are stimulated by nutrient, (2) by using clays to precipitate algal cells, or (3) by using viruses to attack the algal cells.

For more information visit <http://www.hab.nos.noaa.gov>.



U.S. estuaries with reported moderate to high levels of nuisance or toxic blooms, cited as symptoms of high eutrophication conditions that are caused primarily by nutrients (Bricker et al., 1999).

Sediment Total Organic Carbon

Although TOC exists naturally in estuarine sediments and is the result of the degradation of autochthonous and allochthonous organic materials (e.g., phytoplankton, leaves, twigs, dead organisms), anthropogenic sources of TOC materials (e.g., organic industrial wastes, untreated or only primary-treated sewage) can significantly elevate the level of TOC in sediments. TOC in estuarine sediments is often a source of food for some benthic organisms, and high levels of TOC in estuarine sediments can result in significant changes in benthic community structure and in the predominance of pollution-tolerant species. Increased levels of sediment TOC can also reduce the general availability of organic contaminants (e.g., PAHs, PCBs, pesticides); however, increases in temperature or decreases in dissolved oxygen can sometimes result in the release of these “TOC-bound” and “unavailable” contaminants. Nationally, the level of TOC in estuarine sediments was rated good, with only 3% of estuarine sediments being rated poor (Figure 2-14). The only exception to this rating was Puerto Rico, where estuarine sediments showed high levels of TOC, with 44% of sediments having TOC levels higher than 5% (poor condition).



Figure 2-14. National sediment TOC data (U.S. EPA/NCA).



Benthic Index

The condition of benthic communities in the nation's estuaries is fair to poor. Figure 2-15 shows that 17% of estuarine sediments are characterized by benthic communities that are in poor condition (i.e., the communities have lower-than-expected diversity, are populated by greater-than-expected pollution-tolerant species, or contain fewer-than-expected pollution-sensitive species as measured by multimetric benthic indices). Estuaries in the Northeast and Puerto Rico were rated poor, with 22% and 35% of sediments in those regions having poor benthic communities. Estuaries along the Gulf Coast were rated borderline fair, with 17% of sediments rated poor and an additional 26% rated fair for benthic communities.

For the locations that showed poor benthic community quality or reduced benthic diversity, the co-occurrence of poor environmental quality (exposure from degraded water quality or sediment quality variables) is shown in Figure 2-16. Of the 17% of the nation's estuarine area that had poor benthos, 70% also showed indicators of sediment quality and 42% showed indicators of water quality. These figures indicate generally that impaired benthic condition co-occurred in areas with degraded sediment conditions. This co-occurrence does not imply causation. In fact, numerous sites with documented water and sediment quality degradation showed healthy, unimpaired benthic communities, suggesting that the interaction is complex and that increased environmental stress will not always result in degraded aquatic life. However, the converse—the occurrence of poor benthic community conditions—mostly occurred in areas of environmental degradation.



Coastal Habitat Index

Although the loss of wetland habitats in the United States has been significant over the past 200 years, only small losses of coastal wetlands were documented from 1990 to 2000 (Table 2-2). The coastal habitat index score is the average of the mean long-term, decadal loss rate of coastal wetlands (1780–1990) and the present decadal loss rate of coastal wetlands (1990–2000). During the decade from 1990 to 2000, the United States lost approximately 13,210 acres of coastal

Benthic Index - National (1997–2000)



Figure 2-15. National benthic index condition (U.S. EPA/NCA).

Poor Water/Sediment Quality Indicators that Co-Occur with Low Benthic Diversity - National (1997–2000)

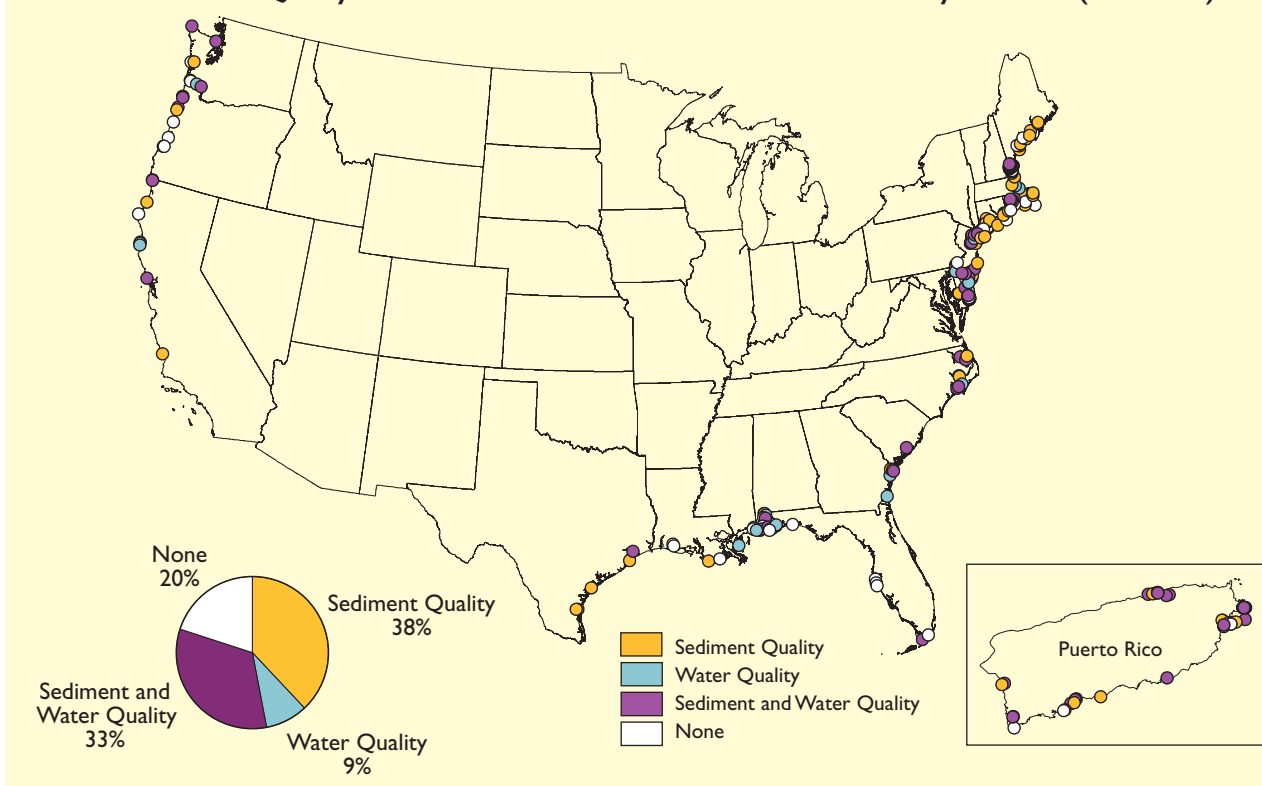


Figure 2-16. Indices and indicators of degraded water/sediment quality that co-occur with poor benthic condition in U.S. estuaries (U.S. EPA/NCA).

wetlands (exclusive of the Great Lakes region). This is a loss rate of about 0.2%. Averaging this recent rate of decadal wetland loss with the mean long-term, decadal loss rate (2.3%) results in a national rating of poor for estuarine condition on the coastal habitat index. The largest index scores were seen in West Coast estuaries (1.90) and in Gulf Coast estuaries (1.30). Because Gulf

Coast wetlands constitute two-thirds of the coastal wetlands in the conterminous 48 states and the Gulf Coast index score is high, the overall national rating for the coastal habitat index is poor (1.26). For the Great Lakes region, researchers used other measurement approaches to assess wetland losses and rated them fair to poor.

Table 2-2. Changes in Marine and Estuarine Wetlands, 1780 to 1990 and 1990 to 2000 (Dahl, 1990; Dahl, 2003).

Coastline or Area	Area 1990 (acres)	Area 2000 (acres)	Change 1990–2000 (acres) (%)	Mean Decadal Loss Rate 1780–1990	Index Value
Alaska	2,132,900	2,132,000	-900 (0.04%)	0.05%	0.05
Hawaii	31,150	No data	—	0.06%	—
Puerto Rico	17,300	No data	—	—	—
Northeast Coast	452,310	451,660	-650 (0.14%)	1.86%	1.00
Southeast Coast	1,107,370	1,105,170	-2,200 (0.20%)	1.91%	1.06
Gulf Coast	3,777,120	3,769,370	-7,750 (0.21%)	2.39%	1.30
West Coast	320,220	318,510	-1,710 (0.53%)	3.26%	1.90
Conterminous 48 States Total	5,657,020	5,644,710	-12,310 (0.22%)	2.30%	1.26
Total (all areas)	7,838,370	7,825,160	-13,210 (0.17%)	1.25%	0.71